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ABSTRACT

Reported is a study of the relationship between student's performance scores and teacher's means of providing evaluative feedback. The sample included 12 classes of 224 students from the tenth through the twelfth grades. The classes included the disciplines of biology, chemistry, and physics including regular, advanced, traditional, PSSC, and Chem-Study courses. The feedback groups on student's laboratory exercises were: a number or letter grade, a grade plus teacher's words as comments, a grade plus a minimum of one-half page of teacher's comments, and a grade plus three to eight minutes of teacher's cassette tape comments. Each of the classes received all four treatments. Data analyses indicated the absence of significant difference in performance. In analyses of each discipline, students in the Chem-Study course favored the tape means, while students in the physics courses were in favor of no-comment feedback. Further studies were recommended on the utilization study concerning the improvement of the use of tape recorders as a feedback treatment. (CC)

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The Cassette Tape Recorder Means Versus Written and Symbolic Means of Providing Feedback of a Student's Performance on Secondary School Science Laboratory Exercises

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Problem

The purpose of this study was to investigate the differences in performance scores on secondary school science laboratory exercises (dependent variable) that resulted from the students receiving a teacher's evaluation via one of four treatments or means of feedback (independent variable). The four means of evaluative feedback were: No Comment (NC) -- laboratory exercise returned with just a number or letter grade as an evaluation; Limited Comment (LC) -- laboratory exercise returned with a number or letter grade plus one word or short phrase teacher comments as an evaluation; Free Writing (FW) -- laboratory exercise returned with a number or letter grade plus, as a minimum, an additional one half page of teacher comments as an evaluation; and Free Tape (FT) -- laboratory exercise returned with a number or letter grade plus, as a minimum, three to eight minutes of teacher comments via a cassette tape as an evaluation. This investigation was designed to determine if there was a significant difference, at the .05 level, in performance among the cassette feedback groups and the other feedback groups when the data from each laboratory exercise, from each class, from each discipline, and from all laboratory exercises, classes and disciplines are combined and analyzed.

The null hypotheses to be tested in this study took the following form: $$Ho: u_{FT} = u_{FW} = u_{LC} = u_{NC}$$

A review of the literature showed that little experimental research has been done on means by which a teacher can provide feedback to a student as an evaluation of his progress toward the instructional objectives. One exception to this lack of experimental research was the study done by Page (1958) in which he found that although a significant difference did not exist between his Free Comment and Specified Comment groups, a significant difference did exist between each of these groups and the No Comment group. The significant

difference was in favor of the treatment groups that received a written feedback. This evidence suggests that feedback, in either of the two written forms, resulted in greater future performance by a student than did no feedback at all. The review of the literature concerning feedback as it related to various learning theories offered further support for the feedback in the instructional process. The cassette tape recorder is simply another means by which the teacher can provide this feedback. The review revealed that neither the tape recorder in general, nor the cassette tape recorder in particular, has been widely used to provide such feedback. In particular, the review revealed that no experimental research has been done in this area. Working on the assumption that the feedback a teacher provides and the actual teaching he does, have, among other things in common, the fact that both are a means of communication between the teacher and the student, this author investigated the use of the tape recorder as a means of teaching. The research reviewed indicates that the tape recorder is an effective means of communication between a teacher and a student when criteria such as achievement, performance, critical thinking ability, interest, and retention are considered. Finally, the review of the literature revealed that the major manufacturers of cassette tape recorders have little research with regard to their use as a means of instruction, and have no research with regard to their use as a means of providing feedback.

Procedure

The procedures used in this study were such that the data could be collected in a normal school situation with as little disturbance to the regular school routine as possible. Although the author was not able to locate a secondary school that was using the cassette tape recorder as a means of feedback, he was able to offset the Hawthorne

Effect by using a school that for at least three years had been using the cassette tape recorder for instructional purposes. The hardware 'gadgetry' seemed to cause minimal if any disturbance in the students' regular school routine.

The sample consisted of four teachers and 224 students from the tenth, eleventh, and twelfth grades making up 12 classes. Although the four teachers were selected on a volunteer basis, the author was able to randomly assign students within each class to the study and to a particular treatment or means of feedback. This resulted in having all four treatments being administered in each of the twelve classes. Although this allowed for the possibility of confounding effects among the treatments, it permitted the investigator to hold the teacher variable constant. Having all four treatments being administered in each of the 12 classes had the added advantage of providing a realistic situation where the teacher as a decision-maker would decide the method (NC, LC, FW, or FT) and amount of feedback to be given each student. This realistic situation would result in different methods of feedback being used at the same time in any given class. Although this procedure might hinder the replicability of the study, it aids the generalizability of the results. The 12 classes represented the disciplines of Biology (Regular and Advanced), Chemistry (Chemistry I and Chem Study), and Physics (Traditional and PSSC).

Analysis of Data

The analysis of the data included statistical applications that permitted the author to 1) avoid the assumption of normality among the variates, and 2) investigate the criterion of performance across disciplines, across classes, and across individual laboratory

exercises. The statistics consisted of using the method of ranks proposed by Friedman (1937) and subsequently used by Page (1958). The following statistical procedures were used:

1. A Friedman chi square (X^2) calculated on the ranks for each laboratory exercise, for each class, for each discipline, and for all classes and disciplines combined.
2. An analysis of variance F test calculated on the means of sums of ranks for each discipline and for the combination of all disciplines.
3. A Behrens-Fisher t' test calculated whenever the analysis of variance F test produced significance at the .05 level.

Although it was expected that the Friedman chi square (X^2) test and the analysis of variance F test would produce similar results, the author applied both tests to determine if such an expectation was true. The F test, although more difficult to calculate than the Friedman chi square (X^2) test, had the advantage of acting as a prerequisite for the Behrens-Fisher t' test.

Conclusions

1. No significant difference in performance was found, at the .05 level, between the cassette tape feedback groups and the other feedback groups when the data from the individual laboratory exercises, the classes, and the combination of all disciplines were combined and analyzed.

2. When the data from each of the disciplines were combined and analyzed, five resulted in no significant difference between the cassette tape feedback groups and the other feedback groups. One, Chem Study, resulted in a significant difference in favor of the Free Tape (FT) means of feedback. Another, Regular Physics plus PSSC Physics, resulted in a significant difference in favor of the

No Comment (NC) means of feedback.

3. The Friedman chi square (X^2) test and the analysis of variance F test produced similar results.

Recommendations

1. Teachers should recognize the cassette tape means of feedback as a fourth means by which they can provide feedback to a student regarding his progress toward the instructional objectives. Although there was generally no significant difference in performance among the treatment groups, it should be noted that neither the teacher nor the students had ever used a cassette tape as a means of feedback, yet without having any pre-study training program the cassette tape feedback groups produced equal performance to those receiving often used and more familiar means of feedback.

2. Do a Utilization study, concerning how to maximize the effect of the cassette tape recorder as a means of feedback, as a follow-up to this Comparative-Effectiveness study. In the present study the teachers were simply given the recorders, shown how to perform the basic operations of record and playback, and then instructed to use them as a fourth means of providing feedback. In a Utilization study, one would investigate such things as what would be the optimal length of a tape used for feedback purposes, what particular activities within a discipline would warrant the cassette tape feedback, what amount of positive and negative criticism should be included in the cassette tape feedback, and what effect would the individual differences that exist among students have upon what should be included in, and who should receive the cassette tape feedback.

3. When only an overall significant difference among ranks is sought, the researcher should use the easily and rapidly applied Friedman chi square (X^2) test, thus saving the more complicated and time consuming analysis of variance F test and subsequent Behrens-Fisher t' or regular t tests for those instances when a particular significance difference between ranks is sought.

Friedman, Milton. "The Use of Ranks to Avoid the Assumption of Normality Implicit in the Analysis of Variance," Journal of the American Statistical Association, XXXII, 1937, pp. 681-687.

Page, Ellis B. "Teacher Comments and Student Performance: A Seventy-Four Classroom Experiment in School Motivation," Journal of Educational Psychology, XLIX, August, 1958, p. 173.